

TOUCH SENSOR USING LIGHT CONTROL

[0001] The present invention relates generally to touch sensors and, more particularly, to touch sensors with light control.

BACKGROUND

[0002] A touch screen offers a simple, intuitive interface to a computer or other data processing device. Rather than using a keyboard to type in data, a user can transfer information through a touch screen by touching an icon or by writing or drawing on a screen. A number of technologies have been developed for sensing the presence of a touch on a touch screen. Touch sensing technologies include, for example, capacitive, resistive, infrared (IR), surface acoustic wave (SAW), and force-based sensors.

[0003] Touch screens are used in a variety of information processing applications. Transparent touch sensors have been particularly useful in interactive systems that also include a computer controlled display. These systems are typically arranged so that information presented on the display can be viewed through the transparent touch screen. The user interacts with the computer system by touching the touch screen at locations indicated by symbols on the display.

[0004] The use of touch screens and displays in interactive applications such as information kiosks, automatic teller machines, and point-of-sale terminals presents a range of challenges. Varying light conditions may lead to degraded readability. Degradation of readability may be more intense, for example, in outdoor locations during periods of direct sunlight or during nighttime when light source reflections become problematic. Privacy viewing, i.e., blocking the view of observers other than the user, is also an important consideration for customers making financial or other personal transactions using a publicly located terminal.

SUMMARY OF THE INVENTION

[0005] The present invention is directed to systems and methods for controlling the direction of viewability of light transmitted through a touch sensor. According to one embodiment, a touch sensing method includes providing an optical control layer as a structural element of a touch sensor. The direction of light through the touch sensor is controlled using the optical control function of the structural element. The structural element can be a substrate or superstrate, for example, and can also provide the touch surface of the touch sensor.

[0006] In accordance with a further embodiment, a touch sensor includes an optical control layer arranged as a structural element of the touch sensor. The optical control layer is configured to control a direction of light through the touch sensor. The touch sensor further includes an active element coupled to the optical control layer and adapted to sense a touch on the touch sensor.

[0007] A further embodiment of the invention involves a process for manufacturing a touch sensor with light control. The process includes providing a structural element of the touch sensor. The structural element is adapted to control the direction of light through the touch sensor. An active element adapted to sense a touch on the touch sensor is formed on the structural element.

[0008] The above summary of the present invention is not intended to describe each embodiment or every implementation of the present invention. Advantages and attainments, together with a more complete understanding of the invention, will become apparent and appreciated by referring to the following detailed description and claims taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 is a block diagram of a touch sensing system with light control in accordance with an embodiment of the invention;

[0010] FIG. 2 is a flowchart illustrating a touch sensing method in accordance with an embodiment of the invention;

[0011] FIG. 3 illustrates the use of a touch screen with light control to enhance the readability of a display in accordance with an embodiment of the invention;

[0012] FIG. 4 illustrates the use of a touch screen with light control to provide privacy viewing of a display in accordance with an embodiment of the invention;

[0013] FIGS. 5A-C are diagrams of touch sensors with light control arranged to implement resistive, capacitive and near field imaging touch sensing technologies in accordance with an embodiment of the invention;

[0014] FIGS. 6A-C are diagrams of touch sensors with light control arranged to implement force, SAW and IR touch sensing technologies in accordance with an embodiment of the invention;

[0015] FIG. 7 is a flowchart illustrating a process for manufacturing a touch sensor in accordance with an embodiment of the invention; and

[0016] FIG. 8 is a flowchart illustrating a process for manufacturing a capacitive touch sensor in accordance with an embodiment of the invention.

[0017] While the invention is amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and will be described in detail. It is to be understood, however, that the intention is not to limit the invention to the particular embodiments described. On the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the scope of the invention as defined by the appended claims.

DETAILED DESCRIPTION

[0018] In the following description of the illustrated embodiments, reference is made to the accompanying drawings which form a part hereof, and in which is shown by way of illustration, various embodiments in which the invention may be practiced. It is to be understood that the embodiments may be utilized and structural changes may be made without departing from the scope of the present invention.

[0019] The present invention is directed to methods and systems for controlling light through a touch sensor. Touch sensors with light control have been found to be particularly useful when used in touch sensing systems incorporating computer control displays. Light control touch sensors may be used in combination with displays of various types, including, for example, cathode ray tube (CRT) displays,